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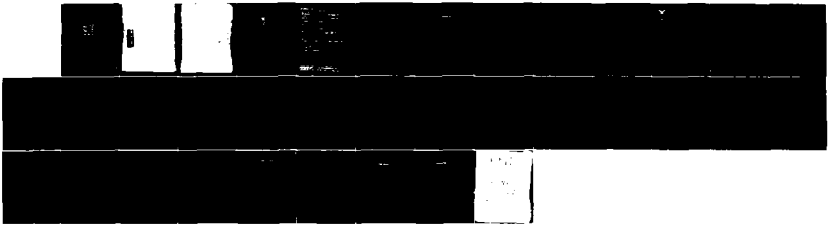

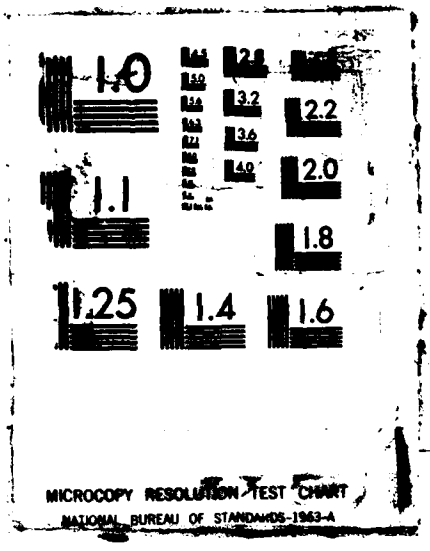
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The purpose of this paper is to identify a method that may be used to electronically pass messages, mail, software, documents, etc, between offices. Alternative ways for implementing a microcomputer based communications capability, using currently installed Zenith-100 microcomputers, within the Air Command and Staff College (ACSC) are discussed. The paper addresses the current environment, future expansion, requirements, alternatives, and recommendations. The proposed method will provide more efficient use of currently installed equipment and software, standardization of software, reduced printing and distribution time, and greatly enhanced coordination cycles.

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PREFACE

The purpose of this paper is to identify a method that may be used to electronically pass messages, mail, software, and documents between offices. Alternative ways for implementing a microcomputer based communications capability within the Air Command and Staff College (ACSC) are discussed. The paper addresses the current environment, future expansion, requirements, alternatives, and recommendations. The proposed method will provide more efficient use of currently installed equipment and software, standardization of software, reduced printing and distribution time, and greatly enhanced coordination cycles.

Keywords: theses; office equipment and supplies

As a result of this project, two pieces of software were acquired and provided to the ACSC staff for use within the school on Zenith-100 microcomputers. Both software packages may be used to support any official Air Force requirement without charge. The Electronic Mail and File Transfer System (EMFTS) was acquired from the Air Force Recruiting Service in San Antonio, Texas. Point of contact is Captain Gary Spencer, AUTOVON 487-3376. The system was delivered on three 5 1/4 inch floppy disks which contained all system software, installation procedures, user's manual, and operator's manual. The communications software package (COMPAC) was acquired from the Air Force Small Computer Office at Gunter AFS, Alabama. Point of contact is Jerry Godwin, AUTOVON 446-4571. This system was delivered on a single 5 1/4 inch floppy disk which contained the system software, installation instructions, and user's guide.

The authors wish to thank the United States Air Force for this educational opportunity, and the following personnel for their support in completing this project:

Capt Gary Spencer, USAF Recruiting Service, San Antonio, Texas.

Capt Hoyt Andrews and Mr. Jerry Godwin, Air Force Small Computer Office, Gunter AFS, Alabama.

CONTINUED

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Mr. Galloway has served with the Air Force as a computer operator and computer specialist. He has extensive experience in computer operations, programming, analysis, acquisition, and installation. He was recently involved in the Air Force's Phase IV program to acquire a new computer system to replace the ageing Burroughs B3500 and Univac 1050-II computers. He also managed an office automation project at Gunter AFS which resulted in the acquisition and installation of over 200 microcomputers to provide a standard office automation capability to support the work force at that facility. He is currently serving as an Information Systems Management Specialist with the Systems Engineering Division at Gunter AFS. He earned a Bachelor of Science (BS) degree, in Computer Science, from Troy State University in 1979.

MAJOR LESTER M. TOVANI

Air Force Experience Related to Research Topic:

Major Tovani is a career military officer with a wide and varied background in communications and information processing. His experience ranges from providing post mission automated data products generated by the SR-71 aircraft, to managing an intelligence network division at Headquarters Strategic Air Command (HQ SAC). He recently served as the program manager for the Automated Command and Control Executive Support System (ACCESS) at HQ SAC. This is a high technology decision support system for senior executive officers to increase productivity and facilitate the flow of information with an integrated computer-based electronic office capability. His education includes a BS from Oregon State University in 1969, and an MBA from Golden Gate University in 1979. He has attended Squadron Officer School (SOS), the Computer Systems Staff Officers Course, and completed the ACSC associate program.

LIST OF ILLUSTRATIONS

TABLES

FIGURES

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Part of our College mission is distribution of the students' problem solving products to DoD sponsors and other interested agencies to enhance insight into contemporary, defense related issues. While the College has accepted this product as meeting academic requirements for graduation, the views and opinions expressed or implied are solely those of the author and should not be construed as carrying official sanction.

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REPORT NUMBER

AUTHOR(S)

TITLE

I. Purpose: The purpose of this paper is to identify a cost effective method to link currently installed microcomputers into a network so that messages, mail, software, and documents can be passed between offices electronically.

II. Problem: Can existing equipment and software within the Air Command and Staff College (ACSC) be configured to provide electronic mail, interoffice exchange of data, and access to common databases for the purposes of providing database updates and the downloading of data for remote applications?

III. Data: The ACSC is the United States Air Force's intermediate service school. Its mission is to enhance the professional knowledge, skills, and perspectives of mid-career officers for increased leadership roles in command and staff positions. One of the primary skills an officer must develop is communication. This paper addresses that facet of communication dealing with the use of personal computers to transfer information electronically in an office automation environment. There are efforts currently underway by AU/XP to install a base-wide local area network

which will cover the entire Maxwell complex including ACSC and the other on-base Professional Military Education facilities (6). However, this effort will only provide an external network for the schools to link into, it will not provide an internal network for the individual schools. It is the responsibility of each school to provide their own internal network (6). ACSC currently has 65 Zenith-100 microcomputers installed in offices throughout the school. Although these microcomputers are being employed primarily to support school administrative functions, ACSC currently relies on manual processes for communication and coordination between offices and the various levels of management. Coordination is basically accomplished using hard copy documents generated by the administrative staff and hand-carried from office to office. Four alternatives were examined to tie these microcomputers and the associated software into a network capability that allows for passing information from office to office electronically.

IV. Conclusion: The alternatives examined have taken growth and flexibility into consideration, will support any future upgrades dictated by Air University, and are capable of being implemented now. A decision on which alternative is the best is dependent on the level of effort, time, money, and support that can be made available. It is possible to implement the alternatives in increments, looking at a short, mid and long term solution, going from low to high cost.

V. Recommendations: It is recommended the school implement an internal local area network using a three-phased approach. Phase one will be a basic bulletin board system using the currently installed Zenith-100 microcomputers, dial-up modems, and government furnished software. This solution is the lowest cost and easiest to implement. It is an interim solution which will satisfy near term requirements and can be phased into a more sophisticated capability at a future date. The second phase is to pursue an upgrade to utilize the AU/TV cable that is in every office and seminar room in building 1402. Technology

provides the ability to transmit video and digital information over the cable at the same time with no interference. Cost for this alternative is more expensive than the basic system described above but is less than the total system Air University (AU) is contracting for and it is compatible with the system AU will install. The third phase would be to integrate into the long range network project currently being worked by AU/XP.

Chapter One

INTRODUCTION

BACKGROUND

The Air Command and Staff College (ACSC) is the intermediate service school for the United States Air Force. Its mission is to enhance the professional knowledge, skills, and perspectives of mid-career officers for increased leadership roles in command and staff positions (1:1). One of the primary skills an officer must develop is communication. This paper addresses that facet of communication dealing with the use of personal computers (PCs) to transfer information electronically in an office automation environment. Table 1 reflects the ACSC organization and staffing posture.

SECTION	PERSONNEL
Command Section (CC)	5
Special Staff (CA)	16
Directorate of Plans and Administration (XP)	18
Director of Operations (DO)	51
Dean of Curriculum (ED)	50
Dean of Associate Programs (EP)	29

Table 1. ACSC Organization

These offices manage and conduct professional military education training for over 550 resident students plus thousands of students enrolled in the ACSC associate program throughout the Air Force.

FOCUS OF PROJECT

This paper concentrates on an ACSC microcomputer based inter-office communications capability. The focus is limited to a capability for the faculty, staff and students within the resident school at Maxwell AFB. The initial goal is to improve data communication to streamline the flow of information. ACSC currently has 65 Zenith-100 (Z-100) microcomputers installed in offices throughout the school. Alternatives are provided for tying these microcomputers and the associated software into a network capability that allows for passing information from office to office electronically. The proposed solution takes into consideration a longer term project, which is currently being worked by AU/XP, to install a base-wide network capable of supporting all school facilities in an on-line environment. The interim solution recommended is capable of being phased into a more sophisticated capability (the AU/XP project) at a future date.

STATEMENT OF PROBLEM

Can existing equipment and software within ACSC be configured to provide electronic mail, interoffice exchange of data, and access to common databases for the purposes of providing database updates and the downloading of data for remote applications?

OBJECTIVES

1. Identify near term ACSC hardware and software requirements for office information system capabilities.

2. Identify equipment and software currently in use, what enhancements are scheduled, what new equipment is planned, and how it is targeted to be used by ACSC.

3. Identify alternatives for satisfying ACSC requirements.

4. Provide and support recommendations for satisfying requirements.

CONSTRAINTS/LIMITATIONS

1. Money for additional equipment and software is limited in the near term.

2. Research is limited to the use of currently installed equipment and software which consists of 65 Z-100 microcomputers and various software packages.

3. Training has to be accomplished in-house.

4. Alternatives addressed must take into consideration the Open Systems Interconnections (OSI) reference model developed by the International Standards Organization (ISO).

5. The lack of adequate resources to implement and support recommended alternatives could delay implementation.

6. Any system implemented as a result of this report must be capable of phasing into the system resulting from the AU/XP project.

ASSUMPTIONS

1. Maintenance support will be available for any software utilized in the alternative chosen to satisfy this requirement.

2. The alternative selected must consider the future impact of upgrading and adding Zenith-158 microcomputers to the system.

Chapter Two

REQUIREMENTS

CURRENT ENVIRONMENT

The microcomputers currently installed at ACSC have various configurations ranging from 192K memory and no printer to 704K memory with letter quality or dot matrix printers. There are up to fourteen different software packages available, but none of these packages are available on all of the microcomputers.

Although these Z-100 microcomputers are being employed to support school functions, ACSC currently relies on manual processes for communication and coordination between the various levels of management and between offices. Coordination is basically accomplished using hard copy documents or floppy disks generated by the staff and hand-carried from office to office. Until recently there was little standardization on the software used by the various offices.

PLANNED ENHANCEMENTS

There is currently a project underway by the school to install a GEMINI board which will allow the use of PC-DOS, Version 3.0, and upgrade available memory to 768K bytes on all systems. Along with this upgrade, a standard set of software is to be installed on each system. This software system, which is marketed by Innovative Software, is called "SMART" and will standardize the wordprocessor, spreadsheet, database, and communications software throughout the school. A complete list of all currently installed equipment and software is included in the appendix.

There is currently a project underway to install a base-wide network to provide needed communications throughout the Maxwell complex. This effort will result in an external network being installed throughout the base. This network will not be extended into any of the

professional military education facilities (6). It will be the responsibility of the individual schools to provide their own internal network which can be interfaced to the external network. This project is being managed by AU/XP and is a long term effort which will require funding and must be supported through the budgeting cycle (11). A long lead time can be expected before implementation can be initiated.

REQUIREMENTS

The requirements to be supported by the AU/XP long range effort have been well documented and are quite exhaustive (10). Those requirements will not be repeated here. Only those requirements that can be satisfied for ACSC in the near term are addressed.

Based on discussions with ACSC/XP personnel, the first requirement to be satisfied is the ability to link the currently installed Z-100 microcomputers together in some way so the administrative and management functions listed below can be supported (6). This capability must be cost effective and be implementable in the near term. It must also lead to and support future implementation of the base-wide network project being worked by AU/XP (10). The second requirement is to standardize the common software used by the various offices throughout the school (6). Standardization is essential for the effective use of a network. Files passed through the network that are not in a compatible format cannot be processed at the receiving terminal. The functions which must be supported include:

Spreadsheet. A capability is required to record, manipulate, and display statistical data. Because of the various methods used to record data by different spreadsheet packages, it is essential this software be standardized throughout the school so all offices will be able to access and review spreadsheet data.

Wordprocessing. The requirement is to standardize wordprocessing software used throughout the school so files can be distributed electronically for review and coordination. The availability of automated word processing systems has greatly increased the ability to perform administrative functions. However, most of the time gained through the use of these software packages continues to be lost in the coordination cycle. For example, the letter that used to take two hours to type and correct can now be typed, corrected, and printed in a fraction of that time, but it can still take many days to coordinate that letter

through the organization. Standardizing the wordprocessing software is the first step in solving the coordination problem

Mail and Memorandums. There is a requirement within ACSC to get mail and memorandums to a particular individual, or to groups of personnel.

Bulletin Board. There is a requirement for a capability to rapidly distribute special announcements, tailored to a specific audience, such as the staff and faculty of ACSC.

Upload/Download files. There is a requirement for a capability to electronically transfer files from one office to another. This capability will allow the secretary, or other staff member, to electronically forward a completed document to other members of the staff for review, comment, or consolidation, and for those reviewers to be able to respond with their input in a like manner.

BENEFITS TO BE REALIZED

Many benefits, both tangible and intangible, can be realized by implementing capabilities to support the requirements stated above. The following benefits in the areas indicated can be expected:

Compatibility. All personnel will have at their disposal a powerful set of equipment and software to aid them in accomplishing their day-to-day activities much more effectively and timely. Standardization will provide a built-in backup throughout the school. All equipment and software used in the system will be compatible. This means if a terminal becomes unusable files can be processed on another terminal in the system.

Training. Once an individual is trained on the system the movement of personnel within the organization can be accomplished with little or no retraining.

Communications. The ability to communicate electronically will greatly improve the ability to keep information flowing in a timely manner throughout the organization.

Word Processing. Creation, changes, and corrections to documents can be made and passed back to the originator in a fraction of the time normally required. In addition, many documents are prepared that require

participation of personnel from different offices, directorates, etc. Standardizing the software will permit consolidation of separately generated parts without difficulty.

Coordination Cycle Time. The ability to electronically transmit documents throughout the organization for review and coordination will reduce coordination cycle time. This will result in more efficient and timely processing of documents by eliminating the time required to physically move the documents from one office to the next.

Reproduction Savings. Information will be passed electronically and displayed on a CRT screen. This will result in a reduction in reproduction and paper costs.

Scheduling. On-line calendars for managerial personnel can be established and maintained on a host computer. This information will be available and can be accessed by all personnel throughout the organization to provide greater visibility and flexibility in planning and scheduling meetings and conferences.

Chapter Three

ALTERNATIVES

There are several alternatives which can be pursued to satisfy the requirements. A decision on which alternative is the best is dependent on the level of effort, time, money, and support that can be made available. Four alternatives are discussed below.

Alternative 1. Wait for Further Direction.

Discussion. Under this alternative ACSC would continue to operate as it is currently operating and wait for further direction. As stated earlier in this report, there are efforts currently underway to install a base-wide local area network (LAN) which will support the entire Maxwell complex. It is reasonable to expect additional guidance from the program manager as that project gets closer to reality. However, since that project will not provide an internal network, none of the stated requirements for ACSC would be satisfied.

Hardware. Currently installed microcomputers would continue to be used as independent workstations.

Software. No additional software would need to be purchased.

Communications. No capability would be available to interface the Z-100 terminals currently installed.

Impact on Requirements. This alternative would not satisfy near term requirements discussed in chapter two of this report.

Cost. N/A.

Alternative 2. Install the Electronic Mail and File Transfer System (EMFTS) Bulletin Board System.

Discussion. The second alternative to be considered is

to install a bulletin board system on the Z-100s currently available throughout ACSC. A bulletin board system provides the capability for individual workstations (Z-100s) to communicate with a host system. A modem and a standard telephone line are used to establish a communications link between the workstation and the host system. As part of the research and analysis accomplished for this report, a bulletin board system was acquired and has been made available to ACSC/XPO for implementation if desired. The system reviewed is the Electronic Mail and File Transfer System (EMFTS). This system is currently being used by the Air Force Recruiting Service in San Antonio, Texas. It allows recruiting centers across the country to dial into the host at San Antonio to get messages and schedules and to upload and download files. EMFTS is available for use to support any official Air Force requirement. This bulletin board system provides the following capabilities:

1. Access Control. Access to the host system can be controlled at three levels: open, partially open, and closed. A completely open system allows unregistered users to read, enter, and kill messages, and upload or download files. A partially open system allows unregistered users to read messages only. A closed system allows access to registered users only. User codes, passwords, and access levels are assigned by the system operator on the host system.

2. Bulletins. Bulletins can be entered into the system for all authorized users to access and review.

3. File Upload and Download. Files can be uploaded from a stand alone terminal to the host or downloaded from the host to the terminal.

4. Mail. Messages can be entered for individual users of the system. If the message is considered private, it can be flagged so only the designated recipient can read the message.

Hardware. The EMFTS system was designed for use on the Z-100 and Z-150 microcomputers; therefore, most of the hardware required to install the system is already in use. There are four other pieces of hardware that will be required to implement EMFTS.

1. Hard Disk. The host system on which EMFTS is installed must have a hard disk. ACSC currently has systems with ten megabyte hard disks. This will be adequate to install EMFTS.

2. Modems. Communications between the remote terminals and the host system is accomplished through the use of modems. It will be necessary to acquire a modem for each remote terminal that is to have access to the host system. There are generally two types of modems that can be used to support this system. A smart modem will be required on the host system. This type of modem will automatically answer an incoming call or will automatically place an outgoing call from the host system. An acoustic type modem, which requires the user to do the actual dialing then place the telephone receiver over the acoustic modem adapter, can be used on the remote terminals. Since the cost of smart modems has dropped so low it is recommended they be used on all terminals. The specific modem recommended CLIN 0015, (Dial Up 2400 BAUD modem, model CTS-2454) from the Zenith Data Systems Small Computer Contract (14:10).

3. Cables. A cable will be required to connect the modem with the microcomputer terminal. The cables (model HCA-54) are packaged with the CLIN 0015 modem (14:10).

4. Phone Lines. Phone lines already installed can be used; however, it may be desirable to have additional lines installed specifically for use by the network.

Software. Software required to implement the EMFTS system includes the EMFTS software, CONDOR DBMS, and a communications software package. The EMFTS software performs the functions discussed above while the communications software allows the remote user to talk directly to EMFTS to perform the desired functions. The CONDOR software is used to maintain system files for maintenance and audit trail purposes and will only be required on the host system. CONDOR is available currently on most Z-100 systems within ACSC so no cost will be incurred to acquire it.

Communications. There are several communications packages which will support the bulletin board system. The package recommended by the Air Force is "COMPAC". This package has been acquired and is available for ACSC to use. Like EMFTS, there are no restrictions on using this software for official Air Force requirements. It may also be possible to use the communications software which is integrated with the "SMART" system currently being installed throughout ACSC.

Impact on Requirements.

1. Communications. Implementation of this alternative will satisfy the requirement to link the Z-100 microcomputers together and provide a capability to add other types of computers at a later date if desired. The interface will be via telephone lines and will be on an as required basis. The host system will have an auto-answer capability and will not require a full time operator. Incoming calls will be automatically answered allowing the user to interface with the EMFTS system. Any number of microcomputers can be included in the system but only one user can access the host at a time.

2. Wordprocessing. Documents created on any stand-alone microcomputer in the system can be transferred to the host, for review by other offices, or they may be transferred to specific individuals.

3. Mail and Memorandums. Mail and memorandums for a particular individual or for the entire staff can be distributed using the EMFTS system.

4. File Transfer. Complete files can be uploaded from a user system to the host or downloaded from the host to a user system.

5. Bulletin Board. A bulletin board capability will be supported to display special bulletins for all users of the system.

Cost. The cost associated with this alternative will be dependent on the number of Z-100 microcomputers used. For the host system, and for each remote microcomputer included in the system, the cost will be $158.00 for a smart modem. The cable to connect the modem to the terminal is packaged with the modem at no extra cost (14:10). The hard disk is already available. If it is determined that additional phone lines should be installed, their cost will have to be included. All required software is already available.

Alternative 3. Install a broadband local area network utilizing existing Cable TV (CATV) wiring, radio-frequency (RF) modems, and file server software.

Discussion. Air University has installed a very extensive CATV system throughout ACSC. This cable is installed in every office and seminar room within building 1402. The properties of coaxial cable will support a

bandwidth of almost 400MHz. Channels can be allocated for voice, video, or data, all of which can be transmitted simultaneously. Local or commercial television channels are transmitted using the standard 6MHz frequency (7:14); therefore, there will be no interference between any school audio-visual programs and the computer network. Contention on the computer network will depend on the number of terminals (workstations) that are connected to the LAN.

Hardware. The first requirement for a LAN is for some type of communication cable to be installed. Since the AU/TV cable is already installed in every office and seminar room, no cost will be incurred for installation of cable. The second requirement is for a microcomputer to serve as a host for the network. The host terminal must have a hard disk and should have at least 512K bytes of memory to maintain system efficiency. All terminals on the network must have an available slot on the back plane to connect a fileserver communications board. Another requirement is a Network Interface Unit (NIU) which controls access to the network. The NIU connects the terminals (PCs) to another piece of required hardware, the RF modem, which is connected to the AU/TV cable. Six to eight users can be connected to one NIU which in turn connects to one RF modem (Figure 1). Connecting the maximum number of PCs to each NIU will help keep the overall cost of the system down although it may have an impact on system efficiency by slowing individual user response times.

Software. File server software will be required on the host PC to control access to the host and for allocation of host disk space. Additional software that resides on the host is application software that controls such things as a bulletin board, file uploads or downloads between two PCs, database management, etc. This software should be standardized between all users on the LAN. Standard software ensures that data generated within a specific application and then transmitted to another user on the network will function at the destination PC without any data modification.

Communications. The bit-per-second (bps) transmission rate of the RF modem should be at least 4800bps and preferably 9600bps to ensure adequate response times at the terminals.

Impact on Requirements. This alternative is primarily a hardware solution and supports software described in previous alternatives. It will support all requirements listed in previous chapters.

Cost. Because of the rapidly changing cost of communications equipment, the cost figures provided below should be considered as estimates. Actual costs will most likely be different by the time a purchase order is prepared.

The host PC requires both hardware and software to support the LAN. The cost of the host server board is $895.00 and the file server software is $1,800.00. If it is decided to install multi-hosts on the LAN these items will have to be purchased for each host. For each PC workstation connected to the LAN, a workstation server board is required at a cost of $650.00 each. In order to connect the PCs (both host and workstations) to the LAN, a NIU and an RF modem are required. The NIU cost $1935.00 and the RF modem cost $700.00 (5). Cost savings can be made by connecting six to eight PCs to one NIU which in turn connects to one RF modem (Figure 1).

Alternative 4. Network Small Clusters of Z-100s.

Discussion. Another alternative that was reviewed involved the possibility of clustering small groups of terminals into a series of small networks with a cluster consisting of a maximum of eight to ten terminals. The capabilities of each of the clusters will satisfy the networking requirements for the small area supported but will fall short of supporting a school wide network requirement.

The system reviewed was the Harris Lanier Multiuser System (9). This system can be used on the Z-100 microcomputers; however, because of the constraints imposed on this analysis, this alternative was not pursued. Implementation would have required an expenditure of approximately $10,000.00 for each eight terminal cluster. Due to the uniqueness of the system, it is doubtful it would be compatible and be able to support the specifications on the Air Force standard network system.

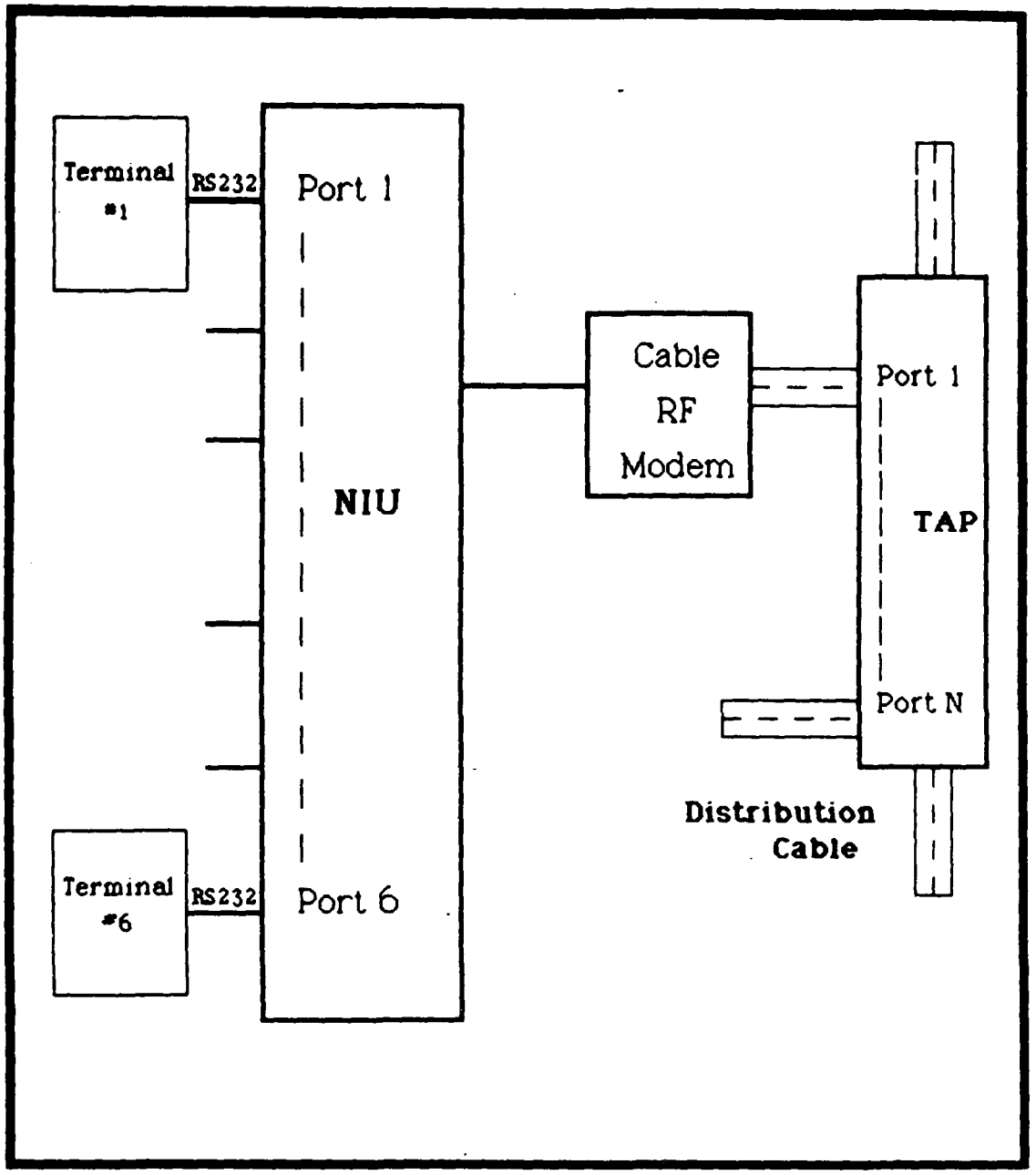

Figure 1 Broadband LAN (6:53)

Chapter Four

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Based on the results of this analysis, it was concluded that it is possible to link the currently installed Z-100 microcomputers and future micro purchases into a network to support the requirements identified in chapter two. The need to standardize software throughout the school is already being satisfied by implementing the "SMART" software system. Installation of this software is currently underway and will be completed in the near future.

Extensive analysis is being conducted by the Air Force on the use of LANs. The announcement of an Air Force standard LAN is expected in the near future. It is not known at this time if the Air Force will recommend a standard set of software to support the standard LAN. The solution selected to support ACSC requirements considers growth and expansion into future standard systems. Hardware and software is flexible to allow integration of new and changing technology. It was also necessary to keep in mind the project being worked by AU/XP to install a base-wide network. Solutions recommended here are capable of evolving into the system resulting from the AU/XP project.

DISCUSSION OF ALTERNATIVES

Alternative 1. Wait for Further Direction.

This alternative provides no benefits for ACSC and does not satisfy the requirements in any way. Even though there is currently action underway to standardize the software used throughout the school, there will not be any capability to link the currently installed 65 Z-100 microcomputers together. Without a capability to interface these computers, the manual process currently being used for communications and coordination will have to be continued and the capabilities of the Z-100s will not be fully

utilized. After the AU/XP project is completed, it will still be the responsibility of the individual schools to provide any internal network. Waiting for additional guidance will not provide that network.

Alternative 2. Install the EMFTS Bulletin Board System.

A Bulletin Board System on the Z-100 microcomputers will satisfy the requirements discussed in chapter two. Implementation of this alternative will provide a capability to communicate between a host system and the stand-alone microcomputers throughout the school. Messages, documents, electronic mail, bulletins, and files can be uploaded to the host system and downloaded from the host by any remote user who has access to the system. Documents to be coordinated can be placed on the system for all coordinating offices to review. Comments can be made and sent back to the originating office electronically. This system also provides the capability for off base access which can be very beneficial. Personnel who are TDY or away from the base can call into the system to check for mail and messages and can send messages to base personnel as required. They also have the capability to generate their trip reports or continue to work on office projects while they are away from the base.

Cost of implementing this alternative is minimal and can be controlled by only purchasing modems and connecting cables for those systems which actually have a need to access the host. It is also possible that multiple users in a single office could share a modem to help keep the overall cost down.

There will be no software cost incurred because the EMFTS and COMPAC software are available for use, without cost, for official government requirements. CONDOR software is already available within ACSC so no additional cost is required.

Alternative 3. Install a broadband local area network utilizing existing Cable TV (CATV) wiring, radio-frequency modems and file server software.

This alternative offers a upward migratable path and should be considered the final solution after the school has had some experience in telecommunications. It will satisfy all near term requirements addressed in chapter two as well as future requirements. The long range goal of the school is to implement a full scale network which will provide on-line support to the entire school. A major concern to installing this type of network is the cost of installing

the cable. At ACSC, cost of installation has no impact because of the extensive CATV that already rings the school. The other major cost items are the NIU, RF modems, and file server software. Based on research completed, the alternative is feasible and is worthy of future consideration.

Alternative 4. Network Small Clusters of Z-100s.

This alternative was reviewed but was not pursued because of the cost required for implementation ($10,000.00 for each cluster of 8). The clusters would not be able to communicate with each other. Also the potential incompatibilities between this system and the Air Force standard network may cause problems in the future.

RECOMMENDATION

The following recommendation is designed to satisfy ACSC requirements. The major factors considered in arriving at the recommendations were: near term requirements discussed in chapter two of this report, the time frame in which the requirements can be satisfied, and the cost of implementation. Additional considerations include the level of support required to install and maintain the system and future expansion requirements.

This recommendation presents a phased approach which will satisfy near term network requirements and set the wheels in motion for further expansion into a full scale network capability in the future.

Recommendation. Although there are near term ACSC requirements which need to be satisfied, future expansion of capabilities must also be considered. The following recommendation is structured into three phases. Phase one will satisfy the near term requirements at a very low cost and can be implemented in a short time frame. Phase two will take longer and cost more to implement but will utilize equipment already installed which will help hold down the total expense. Phase three is the long term implementation of the overall base-wide LAN project being worked by AU/XP.

Phase One. Install a bulletin board system as discussed in alternative 2.

Installing a bulletin board system will go a long way toward satisfying the ACSC requirements. The specific system recommended is the Electronic Mail and File Transfer System. This system was developed for use on the Z-100

series of microcomputers. The software required to implement this system is Air Force proprietary and has already been acquired and turned over to ACSC. The User's Manual, which provides guidance for the terminal users, and the system operator's guide were included with the software. The EMFTS system can be implemented in a short period of time and at a reasonable cost. The only cost associated with implementation, other than manpower, will be hardware (modems) which can be ordered off the Air Force Small Computer Contract (14:10).

It is recommended a small number of workstations be selected for initial implementation. This can be accomplished at a very reasonable cost. These offices will provide a good foundation for baselining and gaining experience on the EMFTS system. Other offices can be added at any time.

Phase Two. Pursue use of TV cable currently installed throughout ACSC.

Using the CATV cable as a means of installing a LAN is a feasible alternative which should be pursued. Utilization of a cable that is already in place will save considerable expense in hardware acquisition and speed up the overall time required to realize a full scale LAN capability for ACSC.

A special study should be initiated to take a closer look at the technical aspects and costs of implementing this alternative at a future date. Sources of information should include AU/XP, AU/TV, Air Force Small Computer Office at Gunter AFS, Hq Strategic Air Command, and technical literature.

Phase Three. Phase three activities are long term and are already underway. This phase will merge the ACSC capabilities resulting from the implementation of phase one and phase two into the final result of the AU/XP project.

One final note that should be considered is maintaining a dial-up modem capability on the network. Having this capability will allow faculty and students to perform a variety of tasks (limited by access control described in alternative 2) from remote workstations not located on Maxwell. The capability will be available with the EMFTS system and should be carried forward into any future system implemented.

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APPENDIX

ACSC COMPUTER EQUIPMENT AND SOFTWARE INVENTORY

LEGEND:

ID--------MACHINE NUMBER	SER NO---------SERIAL NUMBER
BLDG------LOCATION	RM-------------ROOM NUMBER
PRINTER---TYPE PRINTER	ZD-------------ZDOS
MD--------MSDOS	PD-------------PCDOS
UT--------UTILITIES	PT-------------PEACHTEXT
WS--------WORDSTAR	CN-------------CONDOR
GF--------GRAFTALK	ZB-------------ZBASIC
CB--------CBASIC	FT-------------FORTRAN
CC--------CCOBOL	LT-------------LOTUS 123

NOTE: A GEMINI Board and the "SMART" software package is being installed on all systems. When installation is completed, all systems will run the PCDOS software package.

ID	SER NO	BLDG	RM	PRINTER	ZD	MD	PD	UT	PT	WS	CN	GF	ZB	FT	CT	LT
0239	512EE0917	903	5	DIABLO-630		Y		Y		Y	Y		Y	Y		
0073	434ED0435	903	2	MPI-99	Y											
0236	512EE0949	903	3	MPI-99		Y	Y	Y		Y	Y	Y	Y	Y	Y	
0240	512EE0942	903	6	DIABLO-630		Y		Y		Y	Y		Y	Y	Y	
0045	430EE0044	903	6		Y	Y		Y			Y		Y	Y	Y	
????	505EC0784	903	6													
0238	512EE0919	903	6			Y		Y		Y	Y			Y		
0229	535ED1133	903	7	CENT-351	Y	Y		Y		Y	Y					
0231	535ED1149	903	8	MSP-10		Y		Y		Y	Y	Y	Y	Y	Y	
0232	535ED1167	903	14	MPI-99		Y	Y	Y		Y	Y		Y	Y		
0237	512EE0957	903	19	MPI-99		Y	Y	Y		Y	Y	Y	Y	Y	Y	
0244	513EE0311	903	20	DIABLE-630	Y	Y		Y	Y	Y	Y		Y	Y		Y
0218	518EH0508	1402	117		Y	Y			Y	Y	Y					
0267	502EH0973	1402	123			Y			Y	Y	Y		Y		Y	

CONTINUED

ACSC COMPUTER EQUIPMENT AND SOFTWARE INVENTORY

ID	SER NO	BLDG	RM	PRINTER	ZD	MD	PD	UT	PT	WS	CN	GF	ZB	CB	FT	CC	LT
0273	535ED1142	1402	124	DIABLO-630	Y	Y			Y	Y	Y						
0226	518EH0561	1402	125			Y		Y	Y		Y		Y	Y			
0233	535ED1165	1402	126	DIABLE-630		Y		Y	Y		Y						
0072	434ED0573	1402	129							Y							
0253	505EC0819	1402	140		Y				Y		Y		Y	Y			
0044	430EE0078	1402	140A			Y		Y			Y		Y	Y	Y		
0271	513EE0519	1402	142	DIABLO-80N	Y		Y	Y	Y			Y					
0272	535ED1124	1402	144	MPI-99		Y		Y	Y	Y	Y	Y	Y	Y			
0071	434ED0324	1402	147	MPI-99	Y						Y						
0249	505EC0409	1402	148	DIABLO-630		Y		Y		Y	Y	Y	Y	Y			
0252	505EC0433	1402	148			Y		Y		Y	Y						
0220	518EH0709	1402	149	DIABLO-630		Y		Y	Y	Y	Y	Y	Y	Y			
0269	502EH1121	1402	151	DIABLO-630		Y			Y	Y	Y						
0219	518EH0563	1402	152	MPI-99		Y		Y	Y		Y	Y	Y	Y			
0247	505EC0385	1402	154	MPI-99		Y		Y	Y	Y	Y		Y	Y			
0221	518EH0553	1402	156			Y		Y			Y		Y	Y			
0254	505EC0880	1402	172			Y		Y			Y		Y	Y			
0070	434ED0590	1402	181	DIABLO-630	Y				Y	Y	Y	Y	Y	Y			
0223	518EH0813	1402	213	MPI-99		Y		Y	Y	Y	Y		Y	Y			
0248	505EC0408	1402	217			Y		Y	Y		Y		Y	Y			
0234	535ED1123	1402	220	MPI-99		Y	Y	Y	Y		Y		Y	Y			
0246	505EC0357	1402	222	MPI-99		Y			Y		Y		Y	Y			
0270	502EH1136	1402	224	MPI-99		Y			Y	Y	Y						
0403	547EF0325	1402	229	DIABLO-630	Y		Y			Y	Y						
0235	535ED0999	1402	230	OK U83A		Y	Y	Y		Y	Y		Y	Y	Y	Y	
0224	518EH0562	1402	231			Y		Y	Y	Y	Y		Y	Y			
0227	518EH0566	1402	232			Y		Y	Y		Y		Y	Y			
0074	434ED0558	1402	233	MPI-99	Y	Y		Y	Y	Y	Y		Y	Y			
0241	512EE0947	1402	234	DIABLO-630		Y		Y	Y	Y	Y	Y	Y	Y			
0225	518EH0543	1402	234			Y		Y		Y		Y	Y	Y		Y	
0047	430EE0027	1402	235		Y	Y				Y	Y		Y	Y	Y		
0242	512EE0948	1402	235	MPI 180FT		Y	Y	Y		Y							Y
0228	535ED0741	1402	236			Y	Y			Y	Y	Y				Y	
0076	434ED0342	1402	226	MPI-99	Y				Y		Y	Y					
0230	535ED1195	1402	228			Y		Y	Y		Y		Y	Y			

CONTINUED

ACSC COMPUTER EQUIPMENT AND SOFTWARE INVENTORY

ID	SER NO	BLDG	RM	PRINTER	Z D	M D	P D	U T	P T	W S	C N	G F	Z B	C B	F T	C C	L T
0043	430EE0007	1402	238			Y		Y					Y	Y			
0250	505EC0417	1402	238	DIABLO-80N		Y		Y	Y	Y	Y	Y	Y	Y			
0268	502EH1091	1402	238			Y	Y	Y	Y	Y	Y	Y	Y	Y			
0222	518EH0538	1402	239	MPI-99		Y		Y	Y	Y	Y		Y	Y			
0251	505EC0419	1402	240	DIABLO-630		Y		Y	Y		Y	Y	Y	Y			
0049	428EE0387	1402	244			Y			Y								
0243	512EE0955	1402	246			Y		Y	Y								
0245	505EC0347	1402	247	DIABLO-630		Y		Y			Y		Y	Y			
0046	430EE0083	1402	248	MPI-99	Y				Y		Y						
0255	510EC0744	1402	249	DIABLO-630		Y		Y	Y		Y		Y	Y			
0042	430EE0041	1402	251			Y		Y		Y	Y		Y	Y			
0040	430EE0024	1402	251	MPI-99	Y				Y		Y						
0075	434ED0580	1402	252			Y		Y		Y	Y		Y	Y			
0041	430EE0090	1402	267	MPI-99	Y				Y		Y						